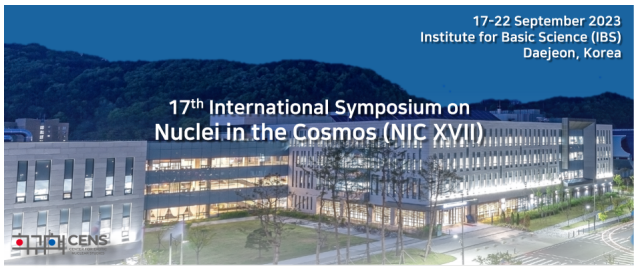

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New determination of ^{17}O+α reaction rates and impact on the s-process in metal-poor rotating massive stars

Monday, 18 September 2023 10:00 (15 minutes)

The efficiency of the weak s-process in low metallicity rotating massive stars depends strongly on the ratio of the reaction rates of the two competing ^{17}O(α,n)^{20}Ne and ^{17}O(α,γ)^{21}Ne reactions, which impacts the poisoning effect of ^{16}O that consumes the neutrons released by the ^{22}Ne(α,n)^{25}Mg reaction [1] .
However, the reaction rates of these two competing reactions are poorly known in the astrophysical energy range of interest due to the lack of spectroscopic information (partial widths, spin-parities) on the relevant states in the compound nucleus ^{21}Ne. Therefore, the α-widths of these states were determined experimentaly for the first time by measuring their α-spectroscopic factors using the α-transfer reaction ^{17}O(^{7}Li,t)^{21}Ne. The latter was performed at MLL-Munich using the high-energy resolution magnetic spectrometer Q3D [2].
The measured differential cross sections of the different populated states as well as their analysis using the DWBA formalism will be presented, along with the obtained α-spectroscopic factors and α-widths of the relevant states in ^{21}Ne. The new ^{17}O(α,n)^{20}Ne and ^{17}O(α, γ)^{21}Ne reaction rates calculated using the obtained α-widths will be presented and compared with previous evaluations. The new rates favour neutron recycling through the ^{17}O(α,n)^{20}Ne reaction and suggest an enhancement by more than 1.5 dex of the weak s-elements between zirconium and neodymium in metal-poor rotating massive stars.

[1] A. Choplin, R. Hirschi et al. Astron. Astrophys. 618, A133 (2018)
[2] F. Hammache, P. Adsley, L. Lamia et al., submitted

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